Machine Translation JP 2005-277719 A

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a lens barrel.
[0002]
[Description of the Prior Art] As a lens barrel which has the two or more-group conventional moving lens group For example, carry out rectilinear-propagation guidance of the two lens groups in the direction of an optical axis approximately, and a follower pin is formed in the housing object of two lens groups approximately [this], respectively. The type which forms the cam groove which makes the follower pin of the lens group before and behind this engage with the cam ring by which a rotation drive is carried out is known, and one cam groove per follower pin of a lens group is needed in this case.
[0003] For this reason, when two or more lens groups are prepared, many cam grooves are needed, and according to the problem on the tooth space of the hoop direction of a cam ring, the problem that it becomes difficult to form a cam groove in a cam ring arises, and when especially the path of a cam ring is small, this problem appears notably.
[0004] If it does in this way, un-smooth ********** and a follower pin will stop moreover, a motion of a follower pin moving, although it is possible to enlarge whenever [to the hoop direction of the cam ring of a cam groove / tilt-angle] as a policy for solving this problem (to let a cam groove stand). Furthermore, since many cam grooves will be formed in a cam ring when the number of follower pins increases, the problem that the reinforcement of a cam ring will fall occurs.
[0005]
[Objects of the Invention] This invention aims at obtaining the lens barrel which can stop the fall of the reinforcement of a cam ring to the minimum while a follower pin can form in a cam ring the cam groove which can operate smoothly, without enlarging the path of a cam ring, even if the number of a lens group increases.
[0006]
[Summary of the Invention] In the zoom lens lens-barrel which has the cam groove with which the follower pin of the lens group before and behind this is made to engage, and was equipped with cam ring; by which a rotation drive is carried out before and after carrying out rectilinear-propagation guidance of the lens barrel of this invention in the direction of an optical axis -- two lens groups; -- follower pin; formed in the housing object of the lens group before and behind this, respectively -- The cam groove of the above-mentioned cam ring is equipped with a part for a part for the cam slot for pre-group lenses, and the cam slot for back group lenses in the shape of a continuous quirk. It is characterized by making the configuration which one lens group of said pre-group lens group or a back group lens group passes a part of cam groove for lens groups of another side, and faces a part for one [said] cam slot for lens groups.
[0007] When it has the zoom section for pre-group lenses, the zoom section for back group lenses, the receipt section for pre-group lenses, and the receipt section for back group lenses and a pre-group lens moves in order during the zoom section and receipt section, as for a cam groove, it is desirable to pass along the zoom section for back group lenses.

[0008]
[Embodiment of the Invention] [Explanation of whole zoom lens lens-barrel] illustration implementation gestalt is an operation gestalt which applied this invention to the zoom lens lens-barrel for digital still cameras. As for the lens system of this operation gestalt, sequentially from a body side, it is 3 group type which has the 1st lens group L1, the 2nd lens group L2, and the 3rd lens group L3, and while the 1st lens group L1 and the 2nd lens group L2 change air spacing, it moves in an optical-axis top, zooming is made, and focusing is made by the 3rd lens group L3 so that clearly [drawing 5 thru/or drawing 7].
[0009] In this zoom lens lens-barrel, the elements (member which carries out neither the translatory movement of the direction of an optical axis nor rotation) fixed to a camera body are the housing 11 shown in drawing 1 thru/or drawing 7 , the shaft presser foot 12, and the fixed ring 13. Fixed flange 13a (the fixed flange of housing 11 is illustration abbreviation) combined mutually is formed in housing 11 and the fixed ring 13. Housing 11 has periphery tubed part 11b which cut and lacked the part, and filter attaching part 11c on an optical axis, and low pass filter 11d is being fixed to filter attaching part 11c. Low pass filter 11d, it is located ahead of solid state image sensor 10a on the substrate 10 fixed in a camera body.
[0010] The fixed ring 13 is located inside periphery tubed part 11b of housing 11. The rotation ring 14 is located in the periphery side (between the fixed ring 13 and periphery tubed part 11b) of this fixed ring 13, and the cam ring 15 is located in an inner circumference side. Cam ring regulation cam-groove 13b (it is three at an equiangular distance to a hoop direction) is formed in the fixed ring 13 as a penetration slot, and follower pin 15b fixed to heavy-gage part 15a of the back end section of the cam ring 15 towards the method of the outside of the direction of a path at this cam ring regulation cam-groove 13b has fitted into it. On the other hand, rotation transfer slot 14a to which fitting of this follower pin 15b is carried out is formed in the inner skin of the rotation ring 14.
[0011] Drawing 11 shows the shape of an extensive form of this rotation transfer slot 14a and cam ring regulation cam-groove 13b. Except for the base (back, edge by the side of a camera body), rotation transfer slot 14a consists of a straight-line slot 14a1 parallel to an optical axis, and has the inclination slot 14a2 and the circumferencial direction slot 14a3 which follow a base in this straight-line slot 14a1. The circumferencial direction slot 14a3 is the section for assembly. On the other hand, cam ring regulation cam-groove 13b has the straight-line slot 13b1 of a direction parallel to the optical axis of a base, the photography condition shift slot 13b2 containing the direction component of an optical axis, and a hoop direction component, and the zoom section slot 13b3 that consists only of a circumferencial direction component. The slot 13b4 exceeding the zoom section slot 13b3 is the section for assembly.
[0012] The rotation ring 14 rotates during the preparation section and the zoom section from the stowed position of drawing 11 . Namely, in drawing 11 , since the rotation ring 14 rotates to the fixed ring 13 currently fixed In the condition (condition that the stowed position and the cam ring 15 are retreating most) that follower pin 15b has got into the base of the inclination slot 14a2, and the straight-line slot 13b1 If the rotation ring 14 rotates, follower pin 15b (cam ring 15) will move in the direction of an optical axis, without being pushed by the inclination slot 14a2 and rotating according to the straight-line slot 13b1. In the condition (preparation section) that follower pin 15b has got into the

straight-line slot 14a1 and the photography condition shift slot 13b2, if the rotation ring 14 rotates, follower pin 15b (cam ring 15) will rotate, being accompanied by optical-axis directional movement according to the photography condition shift slot 13b2. In the condition (zoom section) that follower pin 15b has got into the straight-line slot 14a1 and the zoom section slot 13b3, if the rotation ring 14 rotates, follower pin 15b (cam ring 15) will rotate, without moving in the direction of an optical axis according to the zoom section slot 13b3.

[0013] Gear 14b is formed in the peripheral face of the rotation ring 14, and this gear 14b has geared to the pinion which is not illustrated. A pinion moves in the direction of an optical axis, driving to right reverse and the cam ring 15 rotating due to drawing 11 in response to rotation of this rotation ring 14 with a forward reverse drive motor. If the cam ring 15 is based on the condition of retreating most, actuation of the cam ring 15 accompanying rotation of the above rotation ring 14 carries out only rectilinear propagation first (straight-line slot 13b1), will move in the direction of an optical axis with rotation (the photography condition shift slot 13b2, preparation section), and will carry out only rotation to the last (the zoom section slot 13b3, zoom section).

[0014] In the zoom lens lens-barrel of this operation gestalt, the members to rotate are the rotation ring 14, the cam ring 15, and the barrier closing motion ring 31 mentioned later, and other members carry out rectilinear-propagation migration only in the direction of an optical axis, without rotating (however, 2 group displacement frames 19 rotate slightly so that it may mention later). Next, these rectilinear-propagation member and its guidance device are explained. Between the fixed ring 13 and the cam ring 15, the outside mirror frame ring (rectilinear-propagation guidance ring) 16 and the inside mirror frame ring (rectilinear-propagation guidance ring) 17 are located sequentially from an outside. Heavy-gage part 15a of the cam ring 15 has secured the annular tooth space which puts this cam ring 15, the outside mirror frame ring 16 formed in thin meat between the fixed rings 13, and the inside mirror frame ring 17, and heavy-gage part 15a is being engaged pivotable so that **** harmful to the inner skin of the fixed ring 13 may not arise.

[0015] The outside mirror frame ring 16 of the fixed ring 13 located immediately inside is mirror frame ring body 16r made of synthetic resin from metal reinforcement annular solid 16x, and rectilinear-propagation guidance key 16b (it is three at an equiangular distance to a hoop direction) which projects in the method of the outside of the direction of a path at heavy-gage part 16a of the back end section of mirror frame ring body 16r is formed. Rectilinear-propagation guide rail 13c parallel to the optical axis in which this rectilinear-propagation guidance key 16b is inserted free [sliding] is formed in the inside of the fixed ring 13. Adhesion immobilization was carried out at the front peripheral face of heavy-gage part 16a of the back end section of mirror frame ring body 16r, and metal reinforcement annular solid 16x have contributed to the thinning of the outside mirror frame ring 16, as a result the thinning (minor-diameter-izing) of the whole zoom lens lens-barrel.

[0016] The inside mirror frame ring 17 is mirror frame ring body 17r made of synthetic resin from metal reinforcement annular solid 17x like the outside mirror frame ring 16. Adhesion immobilization was carried out at the front peripheral face of heavy-gage part 17a of the back end section of mirror frame ring body 17r, and metal reinforcement annular solid 17x have contributed to the thinning of the inside mirror frame ring 17, and the thinning (minor-diameter-izing) of the whole zoom lens lens-barrel.

[0017] Rectilinear-propagation guide rail 16c (it is three at an equiangular distance to a hoop direction) parallel to an optical axis is formed in the inside of the outside mirror frame ring 16 (mirror frame ring body 16r), and rectilinear-propagation guidance key 17b projected and formed in this rectilinear-propagation guide rail 16c at heavy-gage part 17a of the back end section of mirror frame ring body 17r has fitted in free [sliding]. Moreover, 16d of two or more bayonet pawls which project in the method of the inside of the direction of a path is formed in the back end section of this outside mirror frame ring 16 (mirror frame ring body 16r), and circular-sulcus 15c which holds 16d of this bayonet pawl free [rotation] by the specific angular position is formed in that back end section periphery at the cam ring 15. With the relation between 16d of this bayonet pawl, and circular-sulcus 15c, without breaking away, the cam ring 15 and the outside mirror frame ring 16 are free for relative rotation, and they have combined it in the direction of an optical axis in the use rotation location so that it may move together.

[0018] Furthermore, inner direction flange 17c is formed ahead [the], and the lens block 40 and the barrier closing motion ring 31 which are mentioned later are being fixed to the inner direction flange by the inside mirror frame ring 17 (mirror frame ring body 17r). Moreover, rectilinear-propagation guidance boss 17d (it is three at an equiangular distance to a hoop direction) which turns [rear face / of this inner direction flange 17c] to a direction parallel to an optical axis is formed. On the other hand, rectilinear-propagation guidance hole 18a (they are three pieces at an equiangular distance to a hoop direction) which fits in free [sliding of this rectilinear-propagation guidance boss 17d] is formed in the part of this inside mirror frame ring 17 which 1 group displacement frame 18 was located immediately inside, among those avoided lens opening and 18d (after-mentioned) of female screw sections of direction flange 18b (drawing 6). This rectilinear-propagation guidance hole 18a is formed in the direction of a path as a hole of the shape of a long gold coin. Since fitting (after-mentioned) of the 1 group displacement frame 18 is carried out to the inner skin of the cam ring 15 even if the fitting clearance between this rectilinear-propagation guidance boss 17d and rectilinear-propagation guidance hole 18a has some path clearance (play), rectilinear-propagation guidance can be carried out in sufficient precision. Moreover, rectilinear-propagation guide rail 18c (it is three at an equiangular distance to a hoop direction) of a direction parallel to an optical axis is formed in the inside of this 1 group-displacement frame 18.

[0019] Two group displacement frames 19 have fitted into the inside of 1 group displacement frame 18. Rectilinear-propagation guidance key 19a which fits into rectilinear-propagation guide rail 18c of 1 group displacement frame 18 is formed in the point periphery of this 2 group-displacement frame 19.

[0020] As for the above fitting relation and rectilinear-propagation guidance relation, rectilinear-propagation guidance of the outside mirror frame ring 16 is carried out from a periphery side to the fixed ring 13 at order. Rectilinear-propagation guidance of the inside mirror frame ring 17 is carried out at the outside mirror frame ring 16, and rectilinear-propagation guidance of the 1 group displacement frame 18 is carried out at the inside mirror frame ring 17. Two group displacement frames 19 can catch in 1 group displacement frame 18 with the relation by which rectilinear-propagation guidance is carried out. Moreover, the rectilinear-propagation guidance relation between the inside mirror frame ring 17 and 1 group displacement frame 18 It is performed by the relation of rectilinear-propagation guidance boss 17d and rectilinear-propagation guidance hole 18a

of 1 group displacement frame 18 which were made to project towards back from the front of the inside mirror frame ring 17 from the front. For this reason, it is not necessary to make another interior material of a rectilinear-propagation proposal intervene within and without the cam ring 15, annular space between the inside mirror frame ring 17 and 1 group displacement frame 18 is made small, and minor diameter-ization is attained.
[0021] 18d of female screw sections which screw in 1 group displacement frame 18 1 group fixed frame 20 which fixed the 1st lens group L1 is formed. The screwing location to 18d of female screw sections of 1 group fixed frame 20 is adjusted at the time of assembly, and adhesion immobilization is carried out after adjustment. The shutter block 21 is inserted into that annular crevice 19b, and this shutter block 21 is fixed to 2 group displacement frames 19 by 2 group displacement frames 19 with a screw (un-illustrating). Moreover, fitting immobilization of the protection-from-light ring (slipping sheet retaining ring) 19c is carried out at 2 group displacement frames 19. The 2nd lens group L2 is located in the core of the shutter block 21, and is being fixed to 2 group displacement frames 19 through 19d of lens presser-foot frames. Adhesion immobilization of the 19d of the lens presser-foot frames is carried out after adjusting the location to 2 group displacement frames 19 of the 2nd lens group L2. The shutter block 21 opens and closes shutter blade 21a according to photographic subject brightness information. As shown in drawing 7 , after being turned up ahead, pasting up on fixed ring 13 periphery from the interior 28 of a proposal which has notching to a part of fixed ring 13 further, after being led to back from this block 21 and turning up back flexible printed circuit board (FPC substrate) 21b which gives an actuating signal to the shutter block 21, it is led to the exterior of housing 11. And the elastic ring (rubber band) 29 which that front end section was located more back than the front end section inside [28] a proposal, and was stopped by hook 11f lets the cuff section ahead of FPC substrate 21b pass in the maximum ****** case, and it was energized in the direction in which FPC substrate 21b separates from an optical axis with this elastic ring 29, and has prevented hanging down into the optical path of FPC substrate 21b in a photography condition.
[0022] The 3rd lens group L3 is being fixed to three group frames 22. As shown in drawing 4 , the end section is fixed to the shaft presser foot 12, three group frames 22 are held free [migration in the direction of an optical axis] along with rectilinear-propagation guidance rod 22a of the pair by which the other end was fixed to housing 10, and migration control is carried out in the direction of an optical axis according to photographic subject distance information with the feed screw 24 by which a rotation drive is carried out with a stepping motor at right reverse.
[0023] Changing mutual air spacing, zooming makes it move in the direction of an optical axis, and performs the 1st lens group L1 (1 group displacement frame 18), the 2nd lens group L2 (2 group displacement frames 19), and the 3rd lens group L3 (three group frames 22). The cam groove C1 (it is three at an equiangular distance to a hoop direction) for lens groups is formed in the inside of the cam ring 15. Rotation is restrained with the rectilinear-propagation guidance relation mentioned above, and 1 group displacement frame 18 and 2 group displacement frames 19 in which only optical-axis directional movement is possible move in the direction of an optical axis with rotation of the cam ring 15 by this cam groove C1 for lens groups. Drawing 8 thru/or drawing 10 show the shape of an extensive form of this cam groove C1 for lens groups, and the cam groove C1

for lens groups in the inside of the cam ring 15 is drawn with a broken line as projection, and by drawing 9 and drawing 10 , it is drawing it as the continuous line at drawing 8 in order to make a configuration clear. The point that this cam groove C1 for lens groups formed the cam profile the object for the 1st lens groups L1, and for 2nd lens group L2 in the profile which the owner bottom followed, And in the stowed position of the 1st lens group L1 and the 2nd lens group L2, the description is that freed the 1st lens group L1 and the 2nd lens group L2, and it made it possible to make it approach to the location where mirror frames contact, and to contain.

[0024] That is, it has fitted in in the cam groove C1 for lens groups both follower pin 18f for 1 groups projected and formed in the external surface of 1 group displacement frame 18 (the 1st lens group L1), and follower pin 19f for 2 groups projected and formed in the external surface of 2 group displacement frames 19 (the 2nd lens group L2). The cam groove C1 for lens groups which is one continuous slot has the function to which the 1st lens group L1 and the 2nd lens group L2 are moved by the independent locus. In the conventional lens barrel, only the number of the lens groups to which it is made to move by the independent locus needed the independent cam groove.

[0025] The cam groove C1 for lens groups of this operation gestalt has the zoom section C 1Z1 for 1 groups, the zoom section C 1Z2 for 2 groups, the receipt open space C one A1 for 1 groups, and the receipt open space C one A2 for 2 groups sequentially from insertion edge C1e (follower pin 18f for 1 groups, and follower pin 19f for 2 groups). the both ends of the zoom section C 1Z1 for 1 groups -- the object for 1 groups -- tele location Z1T and the object for 1 groups -- wide -- the both ends of the zoom section C 1Z2 for location Z1W and 2 groups -- the object for 2 groups -- tele location Z2T and the object for 2 groups -- wide -- it is location Z2W. The flute width of a direction (longitudinal direction in drawing) parallel to an optical axis is widely formed compared with the slot of other sections, and follower pin 18f for 1 groups and follower pin 19f for 2 groups have freely movable space as the receipt open space C one A1 for 1 groups and the receipt open space C one A2 for 2 groups are illustrated. Namely, 1 group receipt open space C one A1 is a configuration long to the hoop direction of a cam ring, and, only as for the screwing adjustment dimension to 1 group displacement frame 18 of 1 group fixed frame 20, follower pin 18f for 1 groups has movable path clearance in the direction of an optical axis. Moreover, 2 group receipt open space C one A2 makes the shape of about 3 square shapes, and has the path clearance of extent which follower pin 19f for 2 groups can move in the hoop direction and the direction of an optical axis of a cam ring greatly.

[0026] Follower pin 18f for 1 groups of 1 group displacement frame 18, and follower pin 19f for 2 groups of 2 group displacement frames 19, the phase of a hoop direction is defined in the receipt rotation location of the cam ring 15 so that it may be located in the receipt open space C one A1 for 1 groups, and the receipt open space C one A2 for 2 groups, respectively. The receipt open space C one A1 for 1 groups and the receipt open space C one A2 for 2 groups do not restrain follower pin 18f for 1 groups, and follower pin 19f for 2 groups. That is, follower pin 18f for 1 groups, and follower pin 19f for 2 groups, it can move in the direction of an optical axis in the receipt open space C one A1 for 1 groups, and the receipt open space C one A2 for 2 groups, and receipt length can be made into min by this path clearance. In addition, about the receipt open space C one A1 for 1 groups, path clearance absorbable enough is given for a changed part of the location

at the time of the receipt of follower pin 18f by the screwing justification to 18d of female screw sections of one group frame 20.

[0027] Among the inside mirror frame rings 17, 17g (drawing 5 , drawing 7) of spring core projections is formed in the hoop direction location different from rectilinear-propagation guidance boss 17d, among 1 group-displacement frames 18, way flange 17c is made to correspond to 17g of this spring core projection, and 18g of spring receipt crevices is formed in way flange 18b at it. Compression spring 30 is inserted between 17g of this spring core projection, and 18g of spring receipt crevices, and migration energization of the 1 group displacement frame 18 is carried out in back. For this reason, 1 group fixed frame 20 currently supported by 1 group displacement frame 18 can retreat to the mechanical location which contacts 2 group displacement frames 19 (protection-from-light ring 19c) by the path clearance which exists between follower pin 18f for 1 groups, and the receipt open space C one A1 for 1 groups. Sign P showed this mechanical contact location to drawing 5 and drawing 6 . Moreover, 2 group displacement frames 19 can retreat to the mechanical location which contacts three group frames 22 by the path clearance which exists between follower pin 19f for 2 groups, and the receipt open space C one A2 for 2 groups. Sign Q showed this mechanical contact location to drawing 5 and drawing 6 . For this reason, as compared with equipment, compaction of receipt length can be aimed at conventionally which has specified strictly the stowed position of the 1st lens group L1 and the 2nd lens group L2 by the cam groove. Furthermore, three group frames 22 can retreat to the location which the spring 23 pushed against the nut attached to the delivery screw is shrunken, and contacts housing 11 mechanically. Sign R showed this mechanical contact location to drawing 5 and drawing 6 . Johan of drawing 5 , drawing 6 , and drawing 7 shows the stowed position where these 1 group fixed frames 20, 2 group displacement frames 19 (protection-from-light ring 19c), three group frames 22, and housing 11 contacted mechanically. In addition, since the location to 1 group displacement frame 18 of 1 group fixed frame 20 gets mixed up by adjustment at the time of assembly, it depends for the movement magnitude to the back of 1 group displacement frame 18 on the location of 1 group fixed frame 20. At the time of receipt, with a spring 30, this amount of adjustments is absorbed and receipt of the lens barrel which can do the contact location shown in PQR is attained.

[0028] When the cam ring 15 rotates in the camera station direction from a receipt rotation location The zoom section C 1Z1 for 1 groups is reached through the zoom section C 1Z2 for 2 groups follower pin 18f for 1 groups in the receipt open space C one A1 for 1 groups, and the zoom section C 1Z2 for 2 groups is reached [from the receipt open space C one A2 for 2 groups] through the receipt open space C one A1 for 1 groups follower pin 19f for 2 groups. Thus, it is useful, in order that it may reduce the number of a cam groove that the zoom section C 1Z2 for 2 groups for follower pin 19f for 2 groups (the 1st lens group L1) is the mere passage section for reaching [from a stowed position] a camera station (zoom section) for follower pin 18f for 1 groups (the 1st lens group L1), it may make arrangement easy and may make an inclination loose.

[0029] The inside mirror frame ring 17 is the same locus as the about 1 group displacement frame 18 independently in 1 group displacement frame 18, and moves in the direction of an optical axis. For this reason, the cam groove C2 (it is three at an equiangular distance to drawing 8 and a hoop direction) for mirror frame rings which makes the inside mirror frame ring 17 by which rectilinear-propagation guidance is

carried out move in the direction of an optical axis is formed in the external surface of the cam ring 15. Follower pin 17f (drawing 8) which projected to the inside of the inside mirror frame ring 17, and was formed in this cam groove C2 for mirror frame rings the shape of an extensive form of the **** cam groove C2 A close resemblance [cam groove / C1 / for lens groups] is borne, and as shown in drawing 8 , it has the section C 2Z1 for 1 groups corresponding to the zoom section, the section C 2Z2 for 2 groups corresponding to the zoom section, and barrier closing motion section C2B sequentially from follower pin 17f insertion edge C2e. Barrier closing motion section C2B is a circumferencial direction slot, and the cam ring 15 and the inside mirror frame ring 17 carry out only relative rotation. Moreover, the cam groove C1 for lens groups of the cam ring 15 and the cam groove C2 for mirror frame rings have shifted the direction location of an optical axis a little, and are located in a line in the direction parallel to an optical axis follower pin 17f of the inside mirror frame ring 17 which fits into the cam groove C2 for mirror frame rings, and follower pin 18f of 1 group displacement frame 18 which fits into the cam groove C1 for lens groups so that clearly [drawing 8].

[0030] Thus, by guiding the inside mirror frame ring 17 exposed to an appearance in the direction of an optical axis by another cam mechanism as another member in 1 group displacement frame 18, it prevents transmitting the external force which joins the inside mirror frame ring 17 from 1 group displacement frame 18 to the 1st lens group L1, and aggravation of the optical-character ability as a zoom lens resulting from a gap of the optical axis of the 1st lens group L1 etc. can be prevented. Moreover, since the cam groove C1 for lens groups and the cam groove C2 for mirror frame rings between which a close resemblance is have shifted the direction location of an optical axis a little, they can receive the force to the method of the inside of the direction of the path which is not made to increase the thickness of the cam ring 15 and moreover joins the inside mirror frame ring 17 by 1 group displacement frame 18 through follower pin 18f for 1 groups. Furthermore, since follower pin 17f which fits into the cam groove C2 for mirror frame rings, and follower pin 18f which fits into the cam groove C1 for lens groups are located in a line in the direction parallel to an optical axis, the spring force of acting in the direction mutually isolated with compression spring 30 between 1 group displacement frame 18 and 2 group-displacement frames 19 by which migration energization is carried out hardly changes with the relative rotation locations of the cam ring 15.

[0031] Insertion immobilization of the barrier block 40 is carried out, and the barrier closing motion ring 31 is supported free [rotation] between way flange 17c among this barrier block 40 and the inside mirror frame ring 17 by the inside of reinforcement annular solid 17x of the inside mirror frame ring 17. Notching 15k is formed in the cam ring 15, and the end face of this notching 15k is 15d of rotation transfer sides of a direction parallel to the optical axis which gives rotation in contact with passive-movement side 31a of this barrier closing motion ring 31, when this cam ring 15 rotates by barrier closing motion section C2B. This notching 15k is formed in the field which avoided the formation field of the cam grooves C1 and C2 of the cam ring 15 as shown in drawing 8 .

[0032] As the barrier block 40 is shown in drawing 2 and drawing 14 To a core, photography opening 41a The barrier housing 41 which it has, the barrier plate 42 of the pair supported by center-of-rotation boss 41b of the pair formed in this barrier housing 41 free [rotation], and the barrier plate 42 of this pair between the barrier close spring

(torsion spring) 43 energized in the closed direction, and the barrier housing 41 Consisting of a barrier plate 42 and a barrier tie-down plate 44 which supports the barrier close spring 43, subashy is beforehand carried out as another unit. Barrier boss 42a (drawing 12 , drawing 13) prepared in the barrier plate 42 of a pair is projected to the barrier closing motion ring 31 side from relief-groove 44a formed in the barrier tie-down plate 44. Closing motion projection 31c of the pair which engages with barrier boss 42a of this pair is formed in the barrier closing motion ring 31. Drawing 12 and drawing 13 are drawings having shown the barrier block 40 by the imaginary line (broken line), and are drawing the condition (drawing 12) that the barrier closing motion ring 31 closed the barrier, and the condition (drawing 13) of being open. Moreover, drawing 14 is drawing at the time of barrier block wearing except the barrier housing 41.

[0033] Rotation energization of the barrier closing motion ring 31 is carried out in the barrier open direction by the tension spring 45 more powerful than the barrier close spring 43 stretched between spring-peg projection 31b formed in self, and 17h of spring-peg projections formed in the inside mirror frame ring 17. Closing motion projection 31c of the barrier closing motion ring 31 opens the barrier plate 42 in contact with barrier boss 42a at the rotation energization edge by tension spring 45 (drawing 13). On the other hand, if the barrier closing motion ring 31 resists the force of tension spring 45 and rotates, closing motion projection 31c will separate from barrier boss 42a, and the barrier plate 42 of a pair will be closed according to the force of the barrier close spring 43 (drawing 12).

[0034] It is 15d of rotation transfer sides formed in the cam ring 15 to resist the force of tension spring 45 and to rotate the barrier closing motion ring 31. The end face of notching 31k formed in the barrier closing motion ring 31 is passive-movement side 31a. When the cam ring 15 is in a stowed position, 15d of rotation transfer sides of the cam ring 15 contacts passive-movement side 31a of the barrier closing motion ring 31 through opening (illustration abbreviation) formed in way flange 17c among the inside mirror frame rings 17. When the barrier closing motion ring 31 resists the force of tension spring 45, and is rotated, the barrier plate 42 closes and the cam ring 15 carries out relative rotation to the inside mirror frame ring 17 in barrier closing motion section C2B (drawing 8), It becomes 15d of rotation transfer sides, and non-contact, and the barrier closing motion ring 31 is energized by the force of tension spring 45, and the barrier plate 42 opens it.

[0035] Drawing 16 shows the motion of 15d of rotation transfer sides in case the cam ring 15 reaches [from a stowed position] the preparation section. the cam ring 15 rotates, moving in the direction of an optical axis according to the relation of cam ring regulation cam-groove 13b of the fixed ring 13, follower pin 15b, and rotation transfer slot 14a of the rotation ring 14 (location of 5, 4, 3, and 2 of drawing 16), and, subsequently carries out only rotation (said -- 2 and 1). In case it moves to these sections 2-1, 15d of rotation transfer sides separates from passive-movement side 31a of the barrier closing motion ring 31, and they open the barrier plate 42. When the cam ring 15 reaches [from the preparation section] a stowed position, the barrier plate 42 is closed by the above and reverse by motion in the sections 1-2 of 15d of rotation transfer sides.

[0036] The barrier plate 42 of a pair consists of a plate fundamentally, and as shown in the inside at drawing 5 and drawing 6 , recess crevice 42most corresponding to curvature of convex L1r of lens side by the side of body of 1st lens group L1 b is formed. This

recess crevice 42b makes it possible to retreat the inside mirror frame ring 17 to a limit at the time of receipt. This recess crevice 42b is formed with the die which carries out resin shaping of the barrier plate 42.

[0037] After fitting in and pasting up the inside mirror frame ring 17 inside reinforcement annular solid 17x, fitting of the above barrier block 40 is carried out to tip opening of reinforcement annular solid 17x, by engaging with the hook (illustration abbreviation) prepared in the inside mirror frame ring 17, it escapes from reinforcement annular solid 17x, and the stop is carried out. And the barrier closing motion ring 31 is supported between way flange 17c among this barrier block 40 and the inside mirror frame ring 17, enabling free rotation. Inside mirror frame ring body 17r made of synthetic resin is made to correspond to the location of the barrier plate 42, notching 17k (drawing 14) into which the barrier plate 42 of an open condition advances is formed in it, and reinforcement annular solid 17x have covered the outside of this notching 17k. With mirror frame ring body 17r made of synthetic resin, penetrated notching 17k can be made to this body 17r by having metal reinforcement annular solid 17x of another object. Although the direction length of a path which requires for the receipt at the time of barrier open can be shortened if the barrier plate 42 of the barrier block 40 is piled up as a four-sheet configuration at the time of receipt, shaft-orientations length takes many, and although an one-sheet configuration or a two-sheet configuration, then shaft-orientations length can be shortened, there is an unescapable problem that the direction length of a path takes many. The effectiveness that increase of the direction length of a path of the inside mirror frame ring 17 can be suppressed is acquired, acquiring the effectiveness that the shaft-orientations length of a two barrier configuration can be shortened like this operation gestalt by forming notching 17k for barrier recess in the inside mirror frame ring 17.

[0038] As mentioned above, the zoom section slot 13b3 of the fixed ring 13 is a circumferencial direction slot without the direction component of an optical axis, and the cam ring 15 carries out only rotation in the photography field (zoom field) to which follower pin 15b of the cam ring 15 moves the inside of the zoom section slot 13b3. In this photography field, in order to take the backlash between follower pin 15b of the cam ring 15, and the zoom section slot 13b3 (play), the energization ring 32 is inserted in the point of the rotation ring 14. Spring-peg projection 32a and spring-peg projection 14c are formed in this energization ring 32 and the rotation ring 14, respectively, the extension spring 33 is stretched between this spring-peg projection 32a and spring-peg projection 14c, and migration energization of the energization ring 32 is carried out in back. As shown in drawing 1 and drawing 4 , three projection (at spacing [hoop direction]) 32c is prepared in the back end section of the inner skin of the energization ring 32, and this projection 32c has penetrated 14d of three through holes prepared in the front end section of the rotation ring 14 inside from the outside of the rotation ring 14. 14d of through holes is prepared just before rotation transfer slot 14a, and projection 32c is located ahead of follower pin 15b which fitted into rotation transfer slot 14a. When follower pin 15b of the cam ring 15 arrives at the zoom section slot 13b3 of the fixed ring 13, contact end-face 32b which makes the back end side of projection 32c carries out migration energization of the follower pin 15b in back, and makes follower pin 15b contact the field on the backside [the zoom section slot 13b3] by contacting this follower pin 15b.

[0039] Although [the above explanation] rectilinear-propagation guide rail 18c of a

direction parallel to an optical axis is formed in the inside of 1 group displacement frame 18 and rectilinear-propagation guidance key 19a which fits into this rectilinear-propagation guide rail 18c is formed in the point external surface of 2 group displacement frames 19 In addition to the above configuration, to the point of rectilinear-propagation guide rail 18c, as shown in drawing 10 , 18h of rotation permission sections which expanded rectilinear-propagation guide rail 18c to the hoop direction is formed, and rectilinear-propagation guidance key 19a (2 group displacement frames 19) can rotate within 18h of this rotation permission section. The rotation field of this 2 group-displacement frame 19 is a time of 2 group displacement frames 19 reaching near the stowed position, and the reason for allowing rotation in this way is as follows. In addition, among 1 group-displacement frames 18, when rectilinear-propagation guidance key 19a of 2 group displacement frames 19 is in 18h of rotation permission sections, hoop direction opening 18j (drawing 3 , drawing 6) to which piece of protrusion 19e containing rectilinear-propagation guidance key 19a prepared in the front end section of 2 group displacement frames 19 projects ahead is formed in way flange 18b (when the 2nd lens L2 is near the stowed position). Thus, compaction of receipt length can be aimed at by making rectilinear-propagation guidance key 19a project ahead from inner direction flange 18b.

[0040] If the cam ring 15 rotates in the lens delivery direction (drawing 10 arrow-head x direction) now in the condition that follower pin 18f for 1 groups is located in the receipt open space C one A1 for 1 groups, by the case where the lens is contained, since follower pin 18f for 1 groups will go into the zoom section C 1Z2 for 2 groups, 1 group displacement frame 18 moves ahead [direction of optical axis]. The this follower pin 18f [for 1 groups] migration location is shown as criteria locations 1, 2, 3, and 4 in drawing 10 . On the other hand, if the cam ring 15 rotates in the x directions, follower pin 19f for 2 groups located in the receipt open space C one A2 for 2 groups, it will be left to the cam ring 15, and will move to the location of two on the inclination edge beta from one in the receipt open space C one A2 for 2 groups, and the slant face xx will be contacted. If the cam ring 15 rotates in the further x directions, according to the slant face xx of the oblique side edge beta of the receipt open space C one A2 for 2 groups, movement with which the following direction components of an optical axis and a hoop direction component were mixed will arise in follower pin 19f for 2 groups. It moved ahead [optical-axis] and the side attachment wall of 18h of rotation permission sections is in contact with rectilinear-propagation guidance key 19a, and according to the force in which 1 group displacement frame 18 moves forward in the direction of an optical axis, 1 group displacement frame 18 rotates 2 group displacement frames 19 in connection with cam follower 19f moving to the location of 3 from the location of 2 along a slant face XX while being pushed ahead [optical-axis]. That is, sliding on the side attachment wall of 18h of rotation permission sections, it rectilinear-propagation guide-rail 18c Passes, and it goes and rectilinear-propagation guidance key 19a is moved. Thus, if relative rotation of the 2 group displacement frames 19 is carried out to 1 group displacement frame 18, 1 group displacement frame 18 can be moved ahead smoothly, without interfering with 2 group displacement frames 19.

[0041] The preparation with which cam follower 19f enters in rectilinear-propagation guide rail 18c of 1 group displacement frame 18 which rotation stops and moves forward along the direction of an optical axis in contact with one wall of rectilinear-propagation

guide rail 18C is completed soon (location 3), and rectilinear-propagation guidance key 19a goes into rectilinear-propagation guide rail 18c by further advance of 1 group guidance ring 18. And after rectilinear-propagation guidance key 19a goes into rectilinear-propagation guide rail 18c, rotation of 2 group displacement frames 19 is restrained, 2 group follower pin 19f moves toward the location of 4 on the slant face xx of the inclination edge beta from the location of 3 shortly, and, thereby, two group frames 19 carry out rectilinear-propagation migration with the migration direction of one group frame in an opposite direction (location 4). If the cam ring 15 rotates further, follower pin 19f for 2 groups will go into the receipt open space C one A1 for 1 groups soon, and 1 group displacement frame 18 and 2 group displacement frames 19 will carry out rectilinear-propagation migration in the direction of an optical axis in rotation of the x directions of the future cam rings 15 according to each section of the cam groove C1 for lens groups (rectilinear-propagation guidance of the 2 group displacement frames 19 is carried out at 1 group displacement frame 18). Thus, the abbreviation triangle-like receipt open space C one A2 for 2 groups It not only secures the path clearance for releasing location regulation of the follower pin 19f direction of an optical axis at the time of receipt, but it forms the oblique side edge beta. While rotating 2 group displacement frames 19, making rectilinear-propagation guidance key 19a go to rectilinear-propagation guide rail 18c and leading to the location which can be engaged, one group frame 18 and two group frames 19 are moved in the direction which conflicts in the direction of an optical axis, and the function which makes both engagement a positive thing is given.

[0042] On the other hand, if the cam ring 15 rotates in the receipt direction (the arrow head x and hard flow of drawing 10) from a photography condition, it will return to the receipt open space C one A1 for 1 groups, and the receipt open space C one A2 for 2 groups follower pin 18f and follower pin 19f, respectively. A motion of follower pin 19f is explained concretely here. Follower pin 19f, after passing along the receipt open space C one A1 for 1 groups, along with the bottom verge section alpha shown by drawing 9 of the receipt open space C one A2 for 2 groups, it moves towards the upper part in drawing 10 . if follower pin 19f comes to a front location a little rather than the endpoint alpha 1 of the bottom verge section alpha soon -- rectilinear-propagation guidance key 19a -- from rectilinear-propagation guide rail 18c -- escaping -- 18h of rotation permission sections -- reaching -- 2 group displacement frames 19 -- 1 group displacement frame 18 -- receiving -- relativity -- it will be in a pivotable condition. Then, an endpoint alpha 1 is arrived at follower pin 19f, the cam ring 15 is interlocked with, and rotation 19, i.e., 2 group displacement frames, carries out relative rotation with 1 group displacement frame 18 at the circumference of a lens optical axis at one. And since follower pin 15b of the cam ring 15 is guided 13b1 of the fixed ring 13 and the cam ring 15 retreats in the direction of an optical axis (it moves rightward among drawing 9), finally it is located in the endpoint alpha 2 in drawing 9 follower pin 19f. Thus, 1 group displacement frame 18 and 2 group displacement frames 19 move to each stowed position smoothly. If the configuration to which 2 group displacement frames 19 are moved to a stowed position only with rectilinear-propagation guidance like 1 group displacement frame 18 is assumed, a cam groove C1 must be turned to the hoop direction (namely, the inside of drawing 9 and an endpoint alpha 1 upper part) of the cam ring 15, and must be formed for a long time, but the way things stand, since it interferes with the cam groove formed in others, in order to avoid interference, the cam ring 15 must be major-diameter-ized.

However, according to the above-mentioned operation gestalt, in the hoop direction of a cam ring, since the cam groove for receipt of 2 group displacement frames 19 can be short set up within limits in which it does not interfere with other cam grooves, it can carry out [minor diameter]-izing of the cam ring 15.

[0043] If this 2 group receipt open space C one A2 is formed in the shape of a straight line by forming in the shape of about 3 square shapes like illustration, when it becomes possible to constitute short the required, still longer cam groove C1 for lens groups and it shortens the cam groove C1 for lens groups in this way, it makes it possible to form three cam grooves C1 for lens groups in the cam ring 15 with a loose tilt angle. Moreover, since 2 group receipt open space C one A2 of such a configuration was formed, when follower pin 18f for 1 groups and follower pin 19f for 2 groups move ahead [direction of optical axis] from a stowed position, It moves follower pin 19f for 2 groups in order of 1, 2, 3, and 4 of drawing 10 which mentioned above the inside of 2 group receipt open space C one A2. Two group displacement frames 19 come to carry out relative rotation to 1 group displacement frame 18, and 18h of rotation permission sections which rectilinear-propagation guidance key 19a of 2 group displacement frames 19 may rotate is prepared in 1 group displacement frame 18.

[0044] Drawing 15 shows the rotational situation to the cam ring of this 2 group-displacement frame 19. One group displacement frame 18 carries out relative rotation of the 2 group displacement frames 19 to a cam ring to correspondence relation with the rotation location of a cam ring existing in the section R of drawing 15 by the cam groove for lens groups.

[0045] Thus, if 1 group displacement frame 18 and 2 group displacement frames 19 carry out relative rotation in a stowed position, since 1 group fixed frame 20 and 2 group displacement frames 19 (protection-from-light ring 19c) which are supported by 1 group displacement frame 18 touch [in the stowed position] mechanically in the contact location P, frictional resistance will pose a problem. Since it ****s in 18d of female screw sections of 1 group displacement frame 18 and has combined with them, especially 1 group fixed frame 20 has a possibility that rotation may arise in 1 group fixed frame 20, and the direction location of an optical axis may be out of order. Then, to protection-from-light ring 19c, he supports the low friction nature sheet 26, for example, the slipping sheet which consists of tetrafluoroethylene resin, and is trying for the back end side of 1 group fixed frame 20 to contact this slipping sheet 26 (drawing 5 , 6, 7 reference).

[0046] Actuation of the stowed position of this zoom lens lens-barrel of the above-mentioned configuration to the whole camera station (zoom location) is as follows. In a stowed position, by the path clearance to which 1 group displacement frame 18 by which migration energization is carried out exists in back according to the force of compression spring 30 between follower pin 18f for 1 groups, and the receipt open space C one A1 for 1 groups It retreats to the mechanical location which contacts 2 group displacement frames 19 (protection-from-light ring 19c). Two group displacement frames 19 By the path clearance which exists between follower pin 19f for 2 groups, and the receipt open space C one A2 for 2 groups, it retreats to the mechanical location which contacts three group frames 22. Further three group frames 22 It is retreating to the location which the spring 23 pushed against the nut attached to the delivery screw is shrunken, and contacts housing 11 mechanically. Compaction of receipt length is aimed at by these mechanical contact. Moreover, in this stowed position, since 15d of rotation transfer sides of the cam

ring 15 pushed passive-movement side 31a, they resisted the force of tension spring 45, the barrier closing motion ring 31 was rotated in the barrier close direction and closing motion projection 31c is separated from barrier boss 42a, the barrier plate 42 has closed photography opening 41a (drawing 12).

[0047] If the rotation ring 14 rotates in the lens delivery direction (preparation section of drawing 11) from this receipt condition, the cam ring 15 which has follower pin 15b will carry out only rectilinear-propagation migration by the straight-line slot 13b1 of the fixed ring 13, and the inclination slot 14a2 of the rotation ring 14. Then, 1 group displacement frame 18 and 2 group displacement frames 19 (protection-from-light ring 19c) which the followers 18f and 19f located in the receipt open space C one A1 of the cam groove C1 for lens groups and C1A2 are pushed by the edge of this cam groove, and move ahead, consequently touch mechanically carry out rectilinear-propagation migration, mutual mechanical contact is dispelled, and the mechanical contact to 2 group displacement frames 19 and three group frames 22 is also dispelled.

[0048] If the rotation ring 14 furthermore rotates in the lens delivery direction, by the photography condition shift slot 13b2 of the fixed ring 13, the cam ring 15 will move in the direction of an optical axis with rotation, and will reach the zoom section slot 13b3 soon. In early stages of rotation of the cam ring 15 by this photography condition shift slot 13b2, 15d of rotation transfer sides of this cam ring 15 separates from passive-movement side 31a of the barrier closing motion ring 31, this barrier closing motion ring 31 rotates in the barrier open direction according to the force of tension spring 45, the force of the barrier close spring 43 is resisted, and the barrier plate 42 is opened. Moreover, just before or after barrier open actuation, 1 group displacement frame 18 carries out relative rotation to 2 group displacement frames 19, 1 group fixed frame 20 is slippery, and it slides on a sheet 26 top.

[0049] Next, by rotation of this direction of the rotation ring 14, if follower pin 15b of the cam ring 15 reaches the zoom section slot 13b3, contact end-face 32b of the back end section of the energization ring 32 will contact follower pin 15b. Since the energization ring 32 is back energized by tension spring 32, it makes follower pin 15b contact the field on the backside [the zoom section slot 13b3] through this contact end-face 32b. While follower pin 15b is located in the zoom section slot 13b3, as long as this relation is maintained and the cam ring 15 is being rotated within the zoom section of drawing 11 through the rotation ring 14, the backlash to the fixed ring 13 of the cam ring 15 is removed.

[0050] If the cam ring 15 rotates from a receipt rotation location to the zoom section through the preparation section as mentioned above, it reached the zoom section C 1Z1 for 1 groups through the zoom section C 1Z2 for 2 groups follower pin 18f for 1 groups in the receipt open space C one A1 for 1 groups of the cam ring 15, and has reached the zoom section C 1Z2 for 2 groups follower pin 19f for 2 groups. If the cam ring 15 rotates within zoom section C1Z1 and C 2Z2, 1 group displacement frame 18 (the 1st lens group L1) and 2 group displacement frames 19 (the 2nd lens group L2) will move in the direction of an optical axis by position relation according to a cam profile, and a synthetic focal distance with the 3rd lens group L3 will change. This zooming is performed by the zoom switch of the common knowledge which is not illustrated. Moreover, when a shutter release carbon button is pushed, a stepping motor rotates only the include angle (rotational frequency) according to photographic subject distance information, the 3rd

lens group L3 (three group frames 22) which is a focal lens group is moved in the direction of an optical axis, and a photographic subject is made to focus. Moreover, the shutter block 21 opens and closes shutter blade 21a according to photographic subject brightness information.

[0051] When 1 group displacement frame 18 carries out rectilinear-propagation migration, the inside mirror frame ring 17 moves in the direction of an optical axis by the cam groove C2 of the configuration similar to the cam groove C1 which has regulated the location of 1 group displacement frame 18, without changing a relative position with this 1 group displacement frame 18. Moreover, with the relation between 16d of bayonet pawls, and circular-sulcus 15c, since the outside mirror frame ring 16 always moves in the direction of an optical axis together with the cam ring 15, both the outside mirror frame rings 16 and inside mirror frame rings 17 that have been exposed to an appearance carry out rectilinear-propagation migration of it in the direction of an optical axis.

[0052] When the cam ring 15 rotates in the direction of a stowed position from the zoom section By actuation contrary to the above, both the outside mirror frame ring 16 and the inside mirror frame ring 17 move to the direction back of an optical axis. One group displacement frame 18 (the 1st lens group L1) and 2 group displacement frames 19 (the 2nd lens group L2) are located in the retreat edge by compression spring 30, and contact mutually. It retreats until it hits against filter attaching part 11c with the spring 23 pushed against the nut with which 2 group displacement frames 19 contact three group frames 22 mechanically, and furthermore stick to the delivery screw and attaches. Moreover, 15d of rotation transfer sides of the cam ring 15 pushes passive-movement side 31a, they resist the force of tension spring 45, the barrier closing motion ring 31 is rotated in the barrier close direction, and the barrier plate 42 closes photography opening 41a.

[0053]

[Explanation of the description part of this invention] Before and after carrying out rectilinear-propagation guidance in the direction of an optical axis, the description part of this invention Two lens groups, In the lens barrel which has the cam groove which makes the follower pin formed, respectively and the follower pin of the lens group before and behind this engage with the housing object of the lens group before and behind this, and was equipped with the cam ring by which a rotation drive is carried out The cam groove of the above-mentioned cam ring is equipped with a part for a part for the cam slot for pre-group lenses, and the cam slot for back group lenses in the shape of a continuous quirk. It is in the point of making the configuration which one lens group of said pre-group lens group or a back group lens group passes a part of cam groove for lens groups of another side, and faces a part for one [said] cam slot for lens groups. Moreover, when the cam groove is equipped with the zoom section for pre-group lenses, the zoom section for back group lenses, the receipt section for pre-group lenses, and the receipt section for back group lenses in order and a pre-group lens moves during the zoom section and receipt section, the point passing through the zoom section for back group lenses is also the description of this invention. Hereafter, this description part is explained.

[0054] In the zoom lens lens-barrel of this operation gestalt, zooming makes the 1st lens group L1 (pre-group lens) (1 group displacement frame 18), the 2nd lens group L2 (back group lens) (2 group displacement frames 19), and the 3rd lens group L3 (three group frames 22) move in the direction of an optical axis, changing mutual air spacing, and is performed. The cam groove C1 (it is three at an equiangular distance to a hoop direction)

for lens groups which has rotation restrained by the inside of the cam ring 15, and moves 1 group displacement frame 18 in which only optical-axis directional movement is possible, and 2 group displacement frames 19 in the direction of an optical axis is formed. As for this cam groove C1 for lens groups, the cam profile the object for the 1st lens groups L1 and for 2nd lens group L2 is formed in one cam groove (profile) which the owner bottom followed.

[0055] That is, it has fitted in in the cam groove C1 for lens groups both follower pin 18f for 1 groups projected and formed in the external surface of 1 group displacement frame 18 (the 1st lens group L1), and follower pin 19f for 2 groups projected and formed in the external surface of 2 group displacement frames 19 (the 2nd lens group L2). The cam groove C1 for lens groups which is one continuous slot has the function to which the 1st lens group L1 and the 2nd lens group L2 are moved by the independent locus. Although only the number of the lens groups to which it is made to move by the independent locus needed the independent cam groove in the conventional lens barrel, the cam groove C1 for lens groups of this operation gestalt has the function to which it is made to move by the locus which became independent by one continuous slot as mentioned above about the 1st lens group L1 and the 2nd lens group L2.

[0056] The cam groove C1 for lens groups of this operation gestalt has the zoom section C 1Z1 for 1 groups, the zoom section C 1Z2 for 2 groups, the receipt open space C one A1 for 1 groups, and the receipt open space C one A2 for 2 groups sequentially from insertion edge C1e (follower pin 18f for 1 groups, and follower pin 19f for 2 groups). the both ends of the zoom section C 1Z1 for 1 groups -- the object for 1 groups -- tele location Z1T and the object for 1 groups -- wide -- the both ends of the zoom section C 1Z2 for location Z1W and 2 groups -- the object for 2 groups -- tele location Z2T and the object for 2 groups -- wide -- it is location Z2W.

[0057] When the cam ring 15 rotates in the camera station direction from a receipt rotation location The zoom section C 1Z1 for 1 groups is reached through the zoom section C 1Z2 for 2 groups follower pin 18f for 1 groups in the receipt open space C one A1 for 1 groups, and the zoom section C 1Z2 for 2 groups is reached [from the receipt open space C one A2 for 2 groups] through the receipt open space C one A1 for 1 groups follower pin 19f for 2 groups. Thus, it is useful, in order that it may reduce the number of a cam groove that the zoom section C 1Z2 for 2 groups for follower pin 19f for 2 groups (the 1st lens group L1) is the mere passage section for reaching [from a stowed position] a camera station (zoom section) for follower pin 18f for 1 groups (the 1st lens group L1), it may make arrangement easy and may make an inclination loose.

[0058] The rectilinear-propagation guidance device of 18 and 19 of an illustration implementation gestalt is an example, and this invention does not ask how of the rectilinear-propagation guidance device of the lens group guided by the lens group cam groove C1. Moreover, it is not necessary to prepare the receipt open space C one A1 and C1A2 into the cam groove C1 for lens groups. Although three of one or more cam grooves C1 for lens groups were formed in the hoop direction in the example of illustration, there should just be theoretically. Moreover, especially in this operation gestalt, although miniaturization of the direction of an optical axis in a receipt condition explained the difficult zoom lens lens-barrel as the best operation gestalt, of course, you may apply to the collapsible mount type lens barrel of the single focus which consists of two or more lens groups.

[0059]
[Effect of the Invention] While a follower pin can form in a cam ring the cam groove which can operate smoothly, without according to this invention being able to stop the number of cam grooves to the minimum, and enlarging the path of a cam ring for this reason, even if the number of lens groups increases since each follower pin of each lens group can be engaged with one cam groove, the fall of the reinforcement of a cam ring can be stopped to the minimum.